



Refractories and Insulation for the Heating Equipment Industry

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Agenda

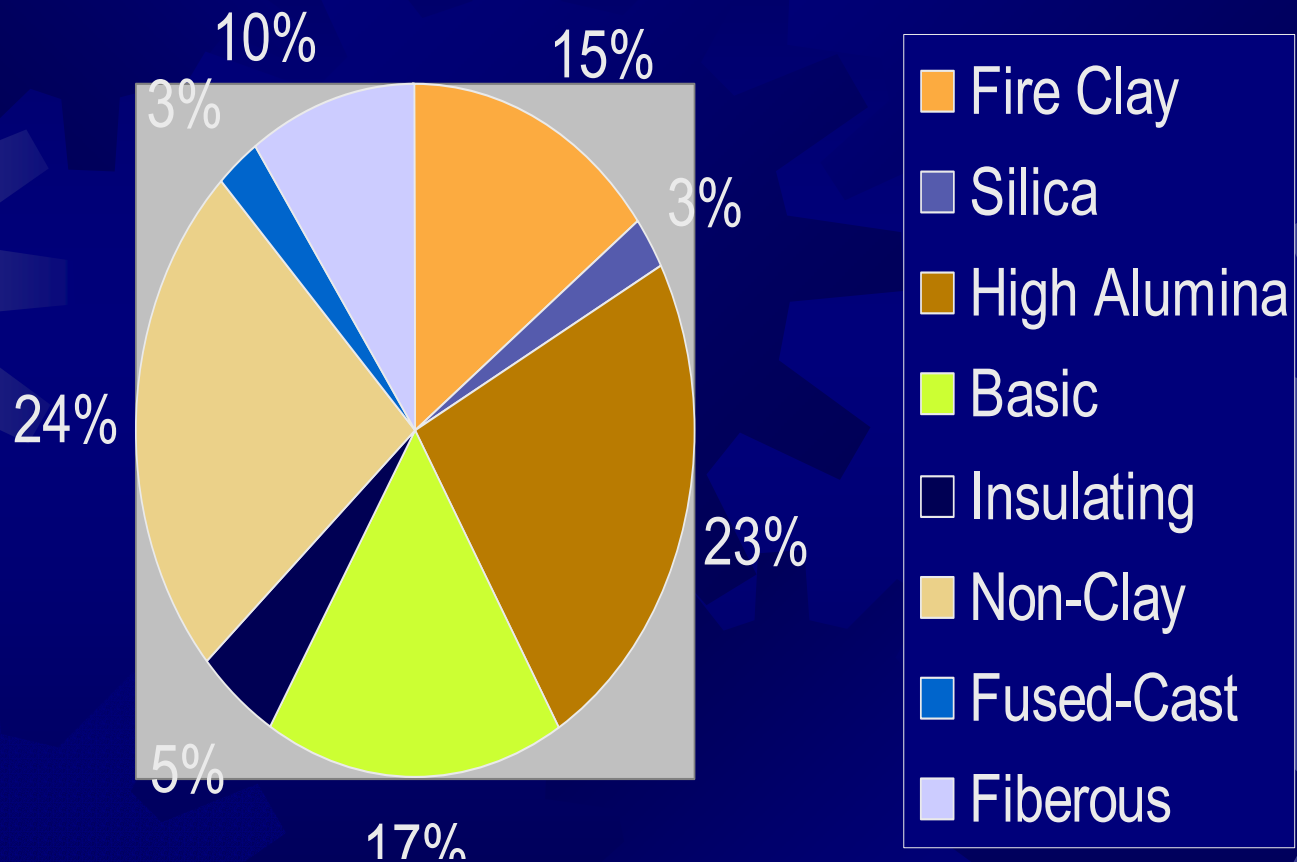
- ✱ Factors Impacting the Industry
- ✱ Standard Materials of Construction
- ✱ Emerging Refractory Technology
- ✱ Barriers to Acceptance
- ✱ Future Refractory Developments



Factors Impacting the Refractory Industry

- ✱ Diminished Customer Base
- ✱ Improved Materials
- ✱ Environmental Regulations
- ✱ Global Competition
- ✱ Business Model
- ✱ Eroding Expertise

Principal Types of Refractories



Refractory Installation Techniques



★ Brick and Special Shapes

Advantages

- Optimum strength
- High density
- Low porosity
- No curing treatment needed

Disadvantages

- Joints
- Labor costs
- Installation (cost and time)
- Availability
- Variable dimensions and warpage
- Internal defects possible

Refractory Installation Techniques



★ Refractory Concrete (Castables)

Advantages

- Fast installation
- Low labor costs
- Availability
- Joint-free (monolithic)
- Anchored installation
- Mechanized placement
- Low permeability
- Fiber addition possible

Disadvantages

- Water/property relations
- Low hot strength
- Forms required
- Slow heat up required

Refractory Installation Techniques



★ Ramming Mixes

Advantages

Joint-free (monolithic)

High density

Availability

Fiber addition possible

Disadvantages

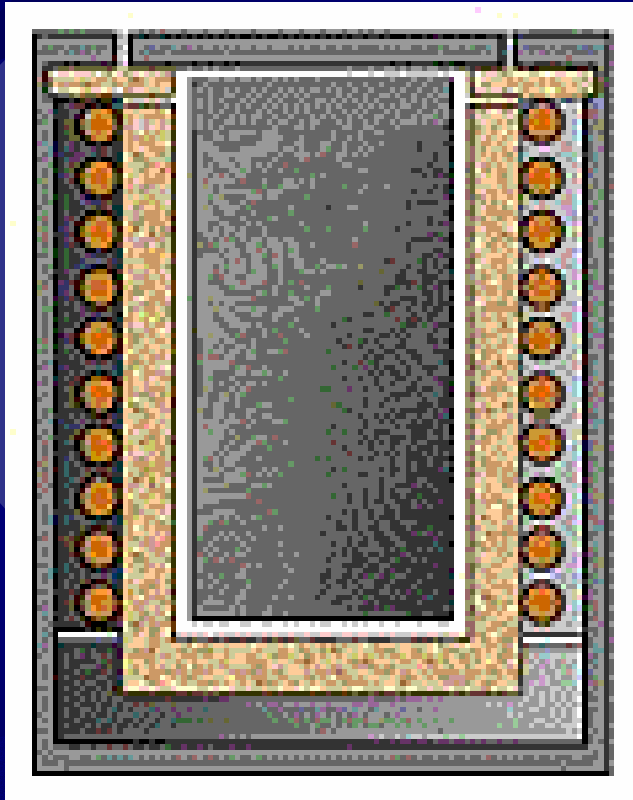
Laminations

Curing treatment needed

Variable density

Forms required (strong and complex)

Refractory Installation Techniques



★ Dry, Heat-Setting Monolithics

Advantages

Joint-free

Long shelf life

Rapid installation and startup availability

Disadvantages

Curing is critical

Forms required

Laminations possible

Installation sensitive

Refractory Installation Techniques



☀ Gunning Mixes

Advantages

Rapid installation (hot or cold)

Joint-free (monolithic)

Availability

Anchored installation

Mechanized placement

Fiber addition possible

Disadvantages

Variable density

Installation skills required

More material needed (rebound losses)

Curing treatment needed

Refractory Installation Techniques



★ Plastics

Advantages

- Joint-free (monolithic)
- High density
- Anchored installation
- Fit odd areas
- Fiber addition possible

Disadvantages

- Low hot strength
- Installation time
- Possible lamination
- Limited shelf life

Refractory Installation Techniques



★ Ceramic/Soluble Fiber Products Advantages

- Low heat loss (energy savings)
- No thermal shock problems
- Installation innovations
- Joint-free
- Addition to existing structure
- Lightweight

Disadvantages

- Permeability
- Low abrasion resistance
- Low mechanical strength

Emerging Refractory Technologies

- ✱ Improved Basic Refractories
- ✱ Growth of Monolithics
- ✱ Improved Binder System
- ✱ New Placement Techniques
- ✱ Fiber Additives
- ✱ Coatings
- ✱ Low-K Backup Linings
- ✱ Exotic Materials

Barriers to Acceptance



- ✱ Market Awareness
- ✱ Material Price vs. value in Service
- ✱ Vested Interests – Labor
- ✱ Risk Aversion
- ✱ Potential Health Concerns
- ✱ Education
- ✱ Equipment
- ✱ Fuel Costs
- ✱ Capital Funds

Factors Affecting the Future of the Refractories Industry



- ✱ Reengineered Industrial Processes
- ✱ The Refractory Paradox
- ✱ Improved Cost Analysis
- ✱ Increased Productivity
- ✱ Reduced Down Time
- ✱ Improve R.O.C.E.
- ✱ Application Driven Supply
- ✱ Business Model
- ✱ Recycling Afterservice Materials
- ✱ Environmental Regulation
- ✱ Energy Costs

Refractory Material Development 2013 and Beyond

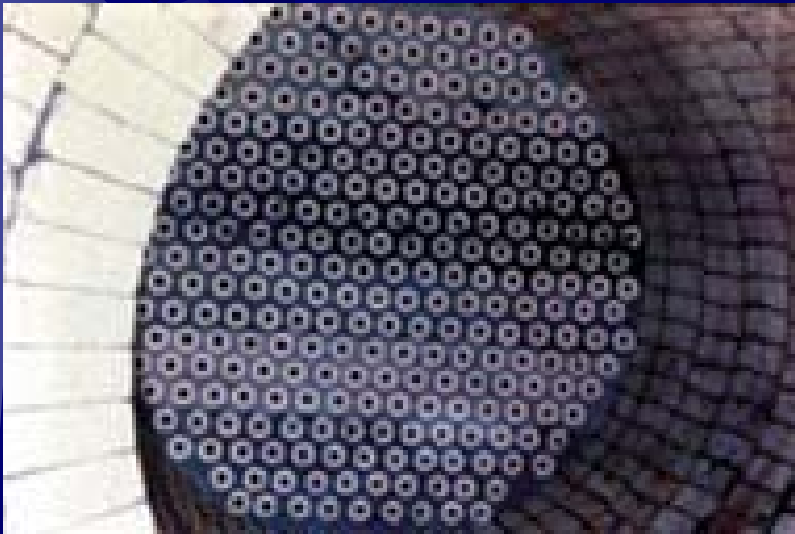
- ✱ Precast Shapes
- ✱ Slag Line Castables
- ✱ Refractory Composites:
Barrier/Structure/Insulation
- ✱ Advanced Reinforcement
- ✱ Reduced Crystalline Silica
- ✱ User Friendly Monolithics
- ✱ Robotic Gunning

Insulation Materials Development 2013 and Beyond



- ✱ Crystalline Silica Free Fibers
- ✱ Improved Soluble Fiber properties
- ✱ Monolithic Fiber Products
- ✱ Hot Patch materials
- ✱ Application specific chemistries
- ✱ Flux Resistant HotFace
- ✱ Improved Fiber binders/Enhanced Properties
- ✱ Improved Thermal Stability

Target Applications for Future Development



- ★ Steel Transfer Ladles
- ★ Sulfur Plant Refractory